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# ECS Project Training Material Volume 8: Configuration Management

Technical Paper

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# Abstract

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This is Volume 8 of a series of 10 volumes containing the training material for the Pre-Release B Testbed of the Earth Observing System Data and Information System (EOSDIS) Core System (ECS). This lesson provides a detailed description of the different tasks that need to be accomplished in order to: record and manage proposed and approved Configuration Change Requests; record, report, and maintain system-level changes to the as-built operational baseline, and generate the Configuration Status Accounting Records.

**Keywords:** training, instructional design, course objective, Configuration Management, Configuration Change Request, software changes, Configuration Status Accounting

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# Introduction

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## Identification

Training Material Volume 8 is part of a series of Technical Papers that will be used to teach Maintenance and Operations (M&O) concepts to the M&O staff at the following Distributed Active Archive Centers (DAACs): Langley Research Center (LaRC), National Snow and Ice Data Center (NSIDC), and EROS Data Center (EDC).

## Scope

Training Material Volume 8 describes the processes and procedures for Maintenance and Operations configuration management (CM) of ECS. This lesson is designed to provide the operations staff with sufficient knowledge and information to satisfy all lesson objectives.

This document reflects the August 23, 1995 Technical Baseline maintained by the contractor Configuration Control Board (CCB) in accordance with ECS technical direction #11, dated December 6, 1994.

## Purpose

The purpose of this Technical Paper is to provide a detailed course of instruction that forms the basis for understanding Configuration Management. Lesson objectives are developed and will be used to guide the flow of instruction for this lesson. The lesson objectives will serve as the basis for verifying that all lesson topics are contained within this Student Guide and slide presentation material.

## Organization

This document is organized as follows:

Introduction:	The Introduction presents the document identification, scope, purpose, and organization.
Student Guide:	The Student Guide identifies the core elements of this lesson. All Lesson Objectives and associated topics are included.
Slide Presentation:	Slide Presentation is reserved for all slides used by the instructor during the presentation of this lesson.

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# Configuration Management Overview

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## Lesson Overview

This lesson will provide you with the process for Configuration Management (CM), including the Configuration Change Request (CCR) Process, the Configuration Change Board (CCB) process, software and hardware baselines and changes, and Configuration Status Accounting. It provides practical experience in using the tools you will need for processing CCRs, software transfer and installation, change control accounting, and baseline management.

## Lesson Objectives

**Overall Objective** - The overall objective of this lesson is proficiency in the methodology and procedures for configuration management (CM) of the Earth Observing System Data and Information System (EOSDIS) Core System (ECS) during maintenance and operations.

**Condition** - The student will be given a baseline configuration for ECS, common CM tools, and a requirement for a change to the baseline.

**Standard** - The student will use CM tools in accordance with prescribed methods and complete required procedures without error to accomplish all coordination and actions necessary to effect the required change.

**Specific Objective 1** - The student will describe the M&O role in ECS CM activities.

**Condition** - The student will be given a timeline depicting major elements of ECS maintenance and operations.

**Standard** - The student will correctly identify the overall CM requirement and specific CM objective of M&O, and correctly list or state a specific M&O role in relation to each of the following: 1) the control of changes at operational sites, 2) the maintenance and operation of science software, and 3) the Sustaining Engineering Organization (SEO) CM function.

**Specific Objective 2** - The student will list the CCBs involved in ECS CM, identify their inter-relationships, and list their responsibilities and functions in ECS CM.

**Condition** - The student will be given a list of ECS CM activities and functions.

**Standard** - The student will identify the position of each CCB within the CCB hierarchy without error, and correctly list at least one major responsibility for each, and correctly list three functions of CM Administrators at SEO and the DAACs.

**Specific Objective 3** - The student will execute the procedure to record, report, document, and distribute a change request.

**Condition** - The student will be given a requirement for a hardware or software change and access to the ECS Change Request Manager (DDTS).

**Standard** - The student will use DDTS correctly to enter data documenting the request, print a report on the request, and identify without error the proper distribution for the report.

**Specific Objective 4** - The student will prepare a request for impact analysis.

**Condition** - The student will be given a written description of a science software upgrade configuration change request.

**Standard** - The student will develop the request for impact analysis, correctly identifying all potentially affected elements of ECS to be analyzed, and use the Change Request Manager software correctly to ensure proper distribution for the impact analysis and impact summary.

**Specific Objective 5** - The student will execute the procedure to record, report, document, and distribute a software change.

**Condition** - The student will be given a requirement for a software change, a software change file, and access to ClearCase®.

**Standard** - The student will use ClearCase® correctly to process the change, print a report documenting the change, identify without error the proper distribution for the change, and successfully accomplish the software transfer and installation.

**Specific Objective 6** - The student will execute the procedure to record, report, document, and distribute a hardware change.

**Condition** - The student will be given a requirement for a hardware change, data on the hardware change, and access to the Change Request Manager software.

**Standard** - The student will use the software correctly to process the change, print a report documenting the change, and identify without error the proper distribution for the change.

## Importance

This lesson provides students who will be CM Administrators at the DAACs , SMC, and SEO with the knowledge and skills needed for effective ECS configuration management. It also provides students who will be System Engineers, System Test Engineers, and Maintenance Engineers at the DAACs with background knowledge and skills for their roles in CM, including implementation and documentation of system-wide changes directed by the Earth Science Data and Information System (ESDIS) CCB and changes directed by a local CCB and/or the Sustaining Engineering Organization (SEO). It ensures management of the capability to:

- control operations across ECS functional segments and operational sites.
- manage successful implementation of large numbers of anticipated system changes.
- interface effectively with interfacing organizations and Change Control Boards (CCBs).

It familiarizes students with:

- the importance of early customer involvement in changes.
- the CM tools to be used in all elements of the ECS Project during operations.
- the organization and interactions among hierarchical CCBs.
- the proper use and deployment of CM database assets to support all CCBs.
- the necessary coordination among all elements involved in accomplishing a change in ECS.

It facilitates the achievement of a streamlined CM approach that ensures local organizations operate effectively with the needed autonomy to accomplish their missions, minimizing outside intervention to promote timely resolution of local problems and to enable change during continued timely production of data products.

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# M&O Role in ECS CM Activities

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The Maintenance and Operations (M&O) CM activities begin when ECS products are accepted by ESDIS at the host operational sites (i.e., pass Release Readiness Review (RRR) or an otherwise formal transition to operations). In the CM concept:

- ECS operations baselines are established at RRR.
- baselines include:
  - COTS hardware and software.
  - custom software.
  - science software.
  - data base schema.
  - related ECS documentation.

Controlling the maintenance and operations changes to ECS products as deployed at the host sites is an ECS Maintenance and Operations (M&O) CM requirement. M&O's specific CM objective is to control the host site's baseline for component changes that may result from:

- system updates.
- introduction of non-ECS components.
- maintenance actions.
- operations actions.

Operational sites each have a change control function, which is referred to as the site Configuration Control Board (CCB) activity. These sites include:

- Distributed Active Archive Centers (DAACs).
- the EOS Operations Center (EOC).
- the ESDIS System Monitoring and Coordination Center (SMC).

M&O is not a decision-making authority, but assists in implementing site-level and project-wide decisions. The M&O organization provides administrative and technical support to site CCBs to coordinate use of approved CM procedures and to ensure that changes to site hardware, software, and procedures are properly documented and coordinated. Specific responsibilities include:

- Configuration identification: maintenance and control of technical documentation.
- Configuration status accounting: recording and reporting information about the configuration status of ECS documentation, hardware, and software throughout the project life cycle.

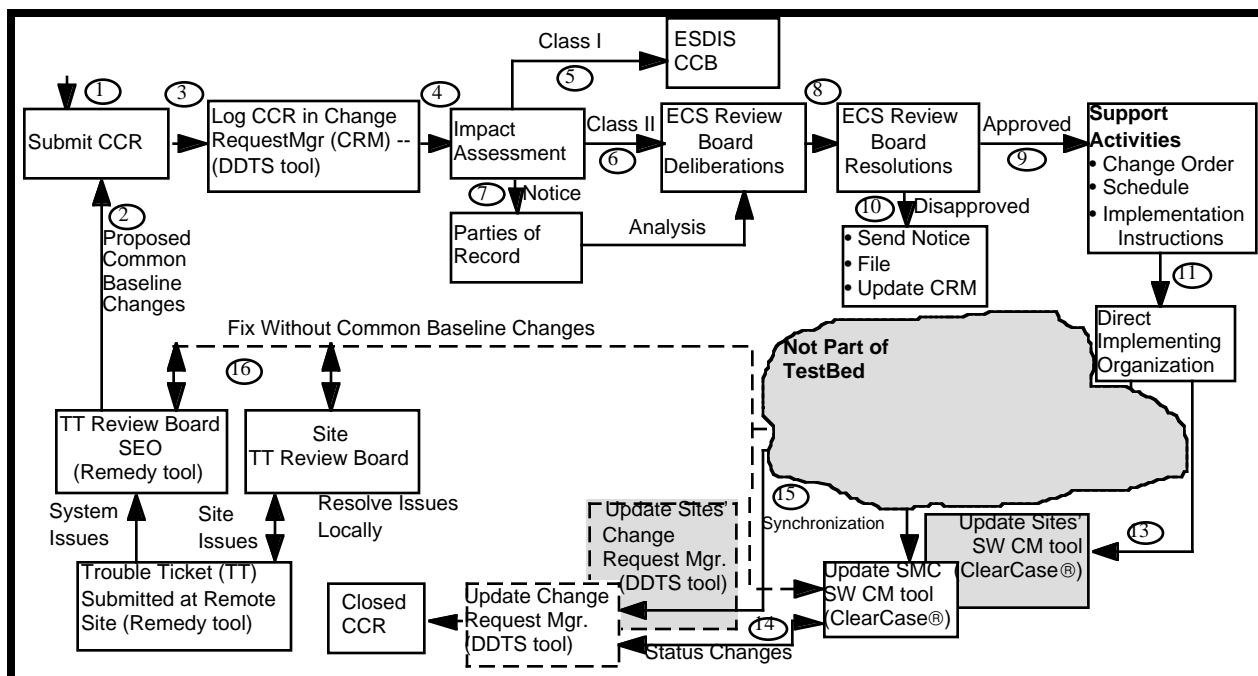
- Configuration audits: M&O supports internal and ESDIS assessments of project compliance with relevant CM plans, to ensure that CM policies, procedures, and practices are followed, that approved changes are properly implemented, and that the as-deployed configuration of ECS matches the as-built documentation of configuration items, or that adequate records of differences are available at all times.

## System-level Change Control

The ECS M&O organization provides administrative and technical support services for the CCB at each site. Change control at the system level is coordinated through an ESDIS-chartered ECS Review Board, supported by the Sustaining Engineering Organization (SEO) and site CCBs. Figure 1 illustrates the work flow for the SEO CM Administrator. Major activities or responsibilities are identified by numbers in the figure and addressed with corresponding numbers in the following discussion.

- Configuration Change Requests (CCRs) are received by the SEO CM Administrator from all sources. Those changes which are designated as from “other sources” (1) may be system enhancements, changes in procedures, changes in external or internal interfaces, or changes in documentation. These changes are not the subject of contemporaneous problem reports first deliberated by the Trouble Ticket Review Board (TTRB) and/or Failure Review Board (FRB).
- Proposed common baseline changes (2) are proposed based on Trouble Ticket (TT) resolutions obtained from the respective review boards. A TT is closed by a corresponding CCR, which may do one of two things:
  - Ratify, or make permanent, a prior temporary/emergency action taken by the TTRB.
  - Consider a normal priority (scheduled) change for incorporation into future change releases.
- The SEO CM Administrator logs the CCR into the Change Request Manager (3). The Change Request Manager is the DDTS tool.
- The CCB chair assigns an evaluator and the SEO CM Administrator coordinates an assessment of the impact of the proposed CCR (4).
- Class I change requests (proposed changes that affect controlled milestones, schedules, budget, cost, and requirements) are forwarded to the ESDIS CCB (5) for consideration with recommendations from the ECS Review Board.
- Class II change requests (proposed changes that affect documentation, alternative use of hardware, correction of software errors, and COTS product substitution without a Class I impact) are considered by ECS Review Board deliberations (6).



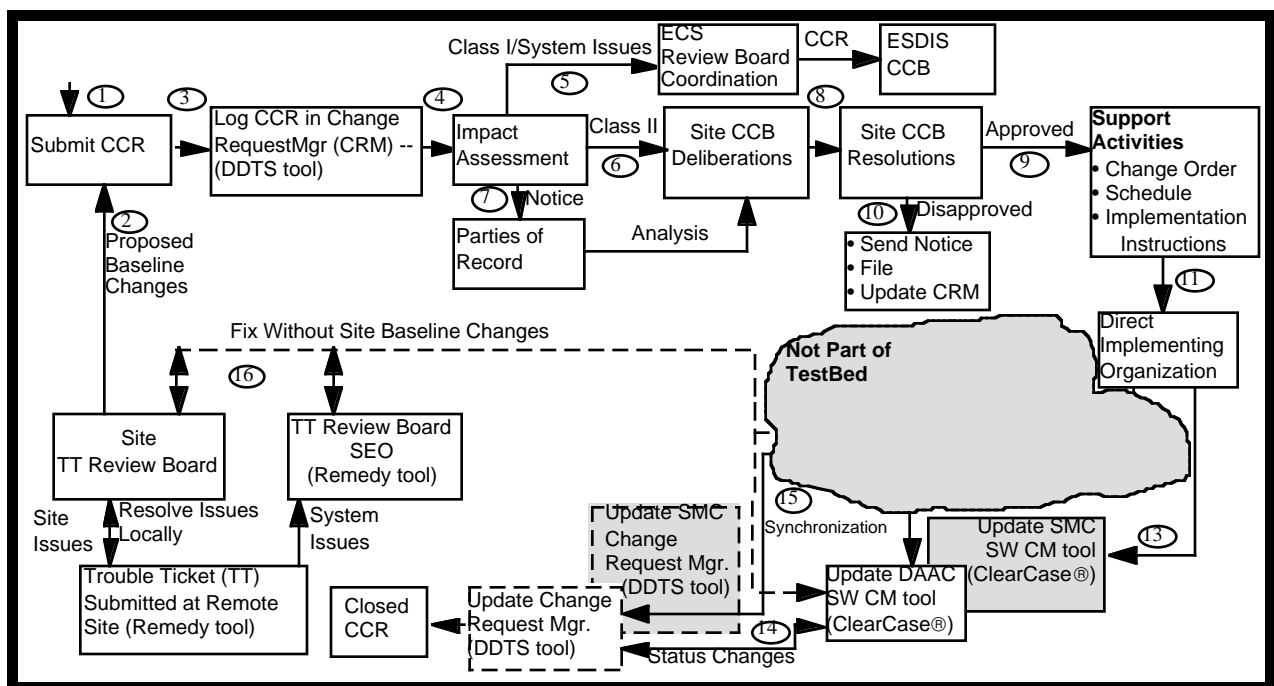


- Notice of proposed changes (7) is distributed to affected parties and review board members to obtain and coordinate impact assessment and optimize the approach to implement proposed changes. These parties review the proposed changes, ensure that all known impacts are identified and defined, help identify factors that will need to be addressed for successful implementation, and identify ways in which implementation can be facilitated.
- The results of ECS Review Board deliberations are factored into review board resolutions (8) which determine whether, when, or where the system changes will be implemented.
- Approved changes (9) are processed by the SEO CM Administrator with change orders, schedules, and implementation instructions to the support activities, i.e., site CCBs, support personnel (SEO), vendors, or others who may be involved in implementing the change.
- Disapproved change requests (10) are processed by the SEO CM Administrator with official notifications, memo to the file, and update of the Change Request Manager (CRM).
- The SEO CM Administrator tracks implementation and closure of CCRs by directions to implementing organizations and their acknowledgments (11) using the CRM tracking and status monitoring features.

- New versions and/or maintenance updates are annotated in the Baseline Manager (12) at the SMC and at the affected sites by following the procedures for configuration identification, activation dates, deactivation dates, and issuing version description documents. (*Note: Baseline Manager is not part of the Testbed.*)
- Concurrently with the Baseline Manager updates, the SW Configuration Management tool (ClearCase®) is updated (13) with directory trees, installation files, and software as required by SW maintenance.
- Status of the activity to implement changes and assigned responsibilities is tracked (14) through closure in the CRM at SEO and at the sites.
- The databases are synchronized (15) by manual checking between applications (Baseline Manager vs. CRM vs. SW CM tool) and automated verification by the SW CM tool for purposes of SW distribution and maintenance. (*Note: Not in Testbed.*)
- The TT Review Board is empowered to make emergency fixes without common baseline changes (16) and to update these changes directly to the Baseline Manager with documentation to follow in the form of the CCR submitted to the appropriate CCB. Proposed common baseline changes must be submitted by CCR to the ECS Review Board. (*Note: Baseline Manager is not part of the Testbed.*)

## Site-Level Change Control

Change control at the site level is depicted in Figure 2, which illustrates the work flow for the site-level CM Administrator. Major activities or responsibilities are identified by numbers in the figure and addressed with corresponding numbers in the following discussion.



**Figure 2. Local Change Control and Site-level CM Administrator Work Flow**

- Configuration Change Requests (CCRs) are received by the Site CM Administrator from all sources with regard to the **site unique extensions** to the operational ECS. Those changes which are designated as from “other sources” (1) may be system enhancements, changes in procedures, changes in external or internal interfaces, or changes in documentation. These changes are not the subject of contemporaneous problem reports first deliberated by the Site/SEO Trouble Ticket Review Board (TTRB) and/or Failure Review Board (FRB).
- Proposed site baseline changes (2) are proposed based on Trouble Ticket (TT) resolutions obtained from the respective review boards. A TT is closed by a corresponding CCR, which may do one of two things:
  - Ratify, or make permanent, a prior temporary/emergency action taken by the TTRB.
  - Consider a normal priority (scheduled) change for incorporation into future change releases.
- The Site CM Administrator logs the CCR into the Change Request Manager (3). The Change Request Manager is the DDTS tool.
- The CCB chair assigns an evaluator and the Site CM Administrator coordinates an assessment of the impact of the proposed CCR (4).
- Class I/System Issues change requests (proposed changes that affect controlled milestones, schedules, budget, cost, and requirements) are forwarded to the ECS Review Board (5) for consideration with recommendations from the Site CCB. Class I issues are further forwarded with recommendations by the ECS Review Board to the ESDIS CCB for consideration.
- Class II change requests (proposed changes that affect documentation, alternative use of hardware, correction of software errors, and COTS product substitution without a Class I impact) are considered by Site CCB deliberations (6).
- Notice of proposed changes (7) is distributed to affected parties and review board members to obtain and coordinate impact assessment and optimize the approach to implement proposed changes.
- The results of Site CCB deliberations are factored into CCB resolutions (8) which determine whether, when, or where the system changes will be implemented.
- Approved changes (9) are processed by the Site CM Administrator with change orders, schedules, and implementation instructions to the support activities, i.e., other CCBs, support personnel (SEO), vendors, or others who may be involved in implementing the change.
- Disapproved change requests (10) are processed by the Site CM Administrator with official notifications, memo to the file, and update of the Change Request Manager (CRM).

- The Site CM Administrator tracks implementation and closure of CCRs by directions to implementing organizations and their acknowledgments (11) using the CRM tracking and status monitoring features.
- New versions and/or maintenance updates are annotated in the Baseline Manager (12) at the affected sites and the SMC by following the procedures for configuration identification, activation dates, deactivation dates, and issuing version description documents. (*Note: Baseline Manager is not part of the Testbed.*)
- Concurrently with the Baseline Manager updates, the SW Configuration Management tool (ClearCase®) is updated (13) with directory trees, installation files, and software as required by SW maintenance.
- Status of the activity to implement changes and assigned responsibilities is tracked (14) through closure in the CRM at the sites.
- The databases are synchronized (15) by manual checking between applications (Baseline Manager vs. CRM vs. SW CM tool) and automated verification by the SW CM tool for purposes of SW distribution and maintenance. (*Note: Not in Testbed.*)
- The on-site TT Review Board is empowered to make emergency fixes without common baseline changes (16) and to update these changes directly to the Baseline Manager with documentation to follow in the form of the CCR submitted to the appropriate CCB. Proposed common baseline changes must be submitted by CCR to the ECS Review Board. (*Note: Baseline Manager is not part of the Testbed.*)

Each site's CCB accepts initial release or updates from the ESDIS CCB. Similarly, the DAAC CCBs accept product generation software from an ESDIS authority. Local tailoring and installation decisions are determined by the site CCB.

## Science Software CM

Each site maintains control over its site operational environment and products developed and/or delivered outside of the ECS project. Science software is one such outside product:

- facilitates the ECS production of Standard Products.
- developed by science investigators at the Science Computing Facilities (SCFs).
- once delivered to the DAAC, it enters the custody of the local DAAC CM organization.
- supported as needed by ECS local personnel.
- Integration and Testing (I&T) conducted by DAAC management in coordination with the local ECS Project's Science Software I&T team.

- after acceptance, revised science software package and all test data are transferred to the control of the local DAAC Manager.
- changes to science software having inter-DAAC dependencies requires coordination with the affected DAACs.
- local DAAC CM organizations ensure that coordination and agreement among ESDIS and affected DAACs is completed before changed science software is moved into production.

## **Sustaining Engineering Organization (SEO)**

The SEO provides a service-oriented organization, standard tools, and processes supplied as CM procedures that can be universally applied to implement ECS on-site CM functions at all operational activities. The SEO performs a range of project-wide CM activities:

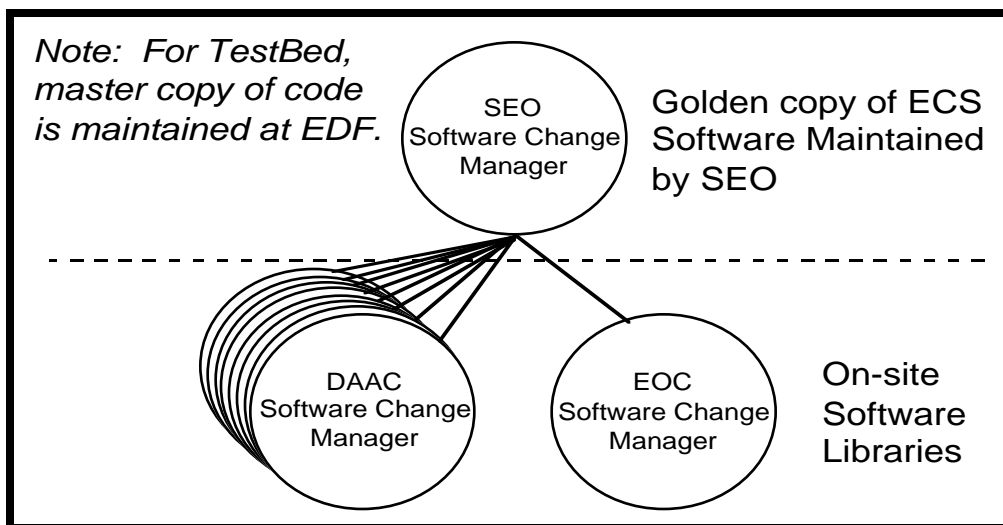
- liaison between the ECS Project on-site activities and the ESDIS CCB.
- coordination of CM functions to ensure that CM procedures are carried out in accordance with the ESDIS CM Plan.
- administrative support to the ESDIS CCB.
- coordination with ECS on-site CCBs.
- maintenance of the Change Request Management System.
- maintenance of a software tool to manage the M&O software libraries for the ECS Project.
- support for ECS Project Reviews and audits.
- oversight for dissemination of controlled items to operational sites.
- monitoring installed configurations of developed software and COTS hardware and software for conformance to approved baselines.

The SEO reviews proposed changes to system-wide ECS operations baselines, assesses impacts of the proposed changes, and provides recommendations to the ESDIS CCB on them.

## Maintenance of the M&O Software (SW) Library

ECS products deployed to the operational sites include software which is common to various operational sites, a golden copy of which is centrally maintained, and software which is site-specific. Both common and site-specific software that has been released for operational use is maintained in the M&O SW Library at each site (On-Site SW Library). As illustrated in Figure 3, the software is under the control of a Software Change Manager (ClearCase®).

- maintained centrally at the SMC (golden copy).
- maintained by site personnel (on-site library).
- supported and controlled by the software tool, Software Change Manager.
  - manages the sharing and control of source, object, and executable files.
  - tracks the software build process so that maintainers can determine what was built and how it was built; can also instantly recreate the source base from which a software system was built, allowing it to be rebuilt, debugged, and updated without interfering with other programming work.
  - automates the enforcement by project administrators of operational policies and procedures.
  - tracks documentation as well as source elements; supports the creation of new element types and the assigning of user-defined attributes to these types; provides for recording of configuration items, with attributes, and a chronological change history for each configuration item.



**Figure 3. Software Change Manager at Central and On-site Software Libraries**

## Baseline Control during Maintenance and Operations

ECS is characterized by a phased implementation and delivery using multiple releases. From an M&O CM perspective, each release has the following major milestones:

- acceptance of each host site's Installation Plan (IP); documents the COTS hardware, the hardware's configuration, and the installation schedule for each site.
- a Consent to Ship Review (CSR); documents the state of the configuration items including the development configuration at the ECS Development Facility (EDF), the actual configuration of each host site's hardware, and the planned configuration of each host site's software.
- a Release Readiness Review (RRR); documents the state of the configuration items including the actual configurations at each of the host sites.
- an Operational Readiness Review (ORR); documents the flight-certified and ESDIS-approved fully integrated EOS Ground System (EGS).

For the Testbed, not a formal release, there is no CSR, RRR, or ORR. Instead, the system is turned over to M&O when the capabilities identified in an Implementation Plan (White Paper 416-WP-001-001, March 1997) have been successfully demonstrated to NASA satisfaction.

Normally, prior to RRR, the development CM controls the baseline. Development organizations follow the practices and procedures of the host site configuration control process for installation of hardware into the facility and use of hardware (including operational test strings).

At RRR, or, for the Testbed, at turnover, M&O CM impounds the configuration including:

- COTS hardware.
- COTS software and control files.
- Custom software source code (*Note: For the Testbed, this code is maintained at the ECS Development Facility.*).
- Custom software binaries.
- Custom software database schema and/or contents.

- Build and installation procedures, job control decks, test, training and operational material, and related documentation; subsequent configuration changes are controlled by the appropriate engineering or operations organization at each site.

## Site Authority

At RRR, the ECS On-Site Organization interfaces with the local site CCB and provides engineering recommendations for requested changes to common software. Change control authority depends on the type of change in question:

- ESDIS - authority over changes to common software for system-wide implementation.
- site CCB - authority over site-specific Class II changes (those not requiring contractual change for implementation).
  - site-specific parameters for COTS software installed at operational sites.
  - specific configuration of tools and utilities installed at local site, as delegated by ESDIS.

## Configuration Identification

Configuration identification establishes unique identifiers for ECS control items to allow for the establishment and maintenance of control and status accounting for the items:

- Hardware.
- Software.
- Databases.
- Documentation.

Configuration identification originates from the ECS Development Configuration Items List (CIL). Therefore, it is necessary to be familiar with developer guidelines for configuration identification and the Configured Article List (CAL). There are several useful references, including:

- ESDIS CM Plan (June 1996).
- MO&DSD CM Plan (September 1995).
- ECS M&O CM Plan (November 1995).
- Software Build Process, CM-1-023 (Project Instruction, 25 March 1996).



- Software Naming Conventions, SD-1-015 (Project Instruction, 14 July 1995).
- Directory and File Name Guidelines and Standards for Release A (15 April 1996).
- Document Numbering, DM-1-002 (Project Instruction, 25 November 1994).
- DoD MIL-STD-973 (April 1992).

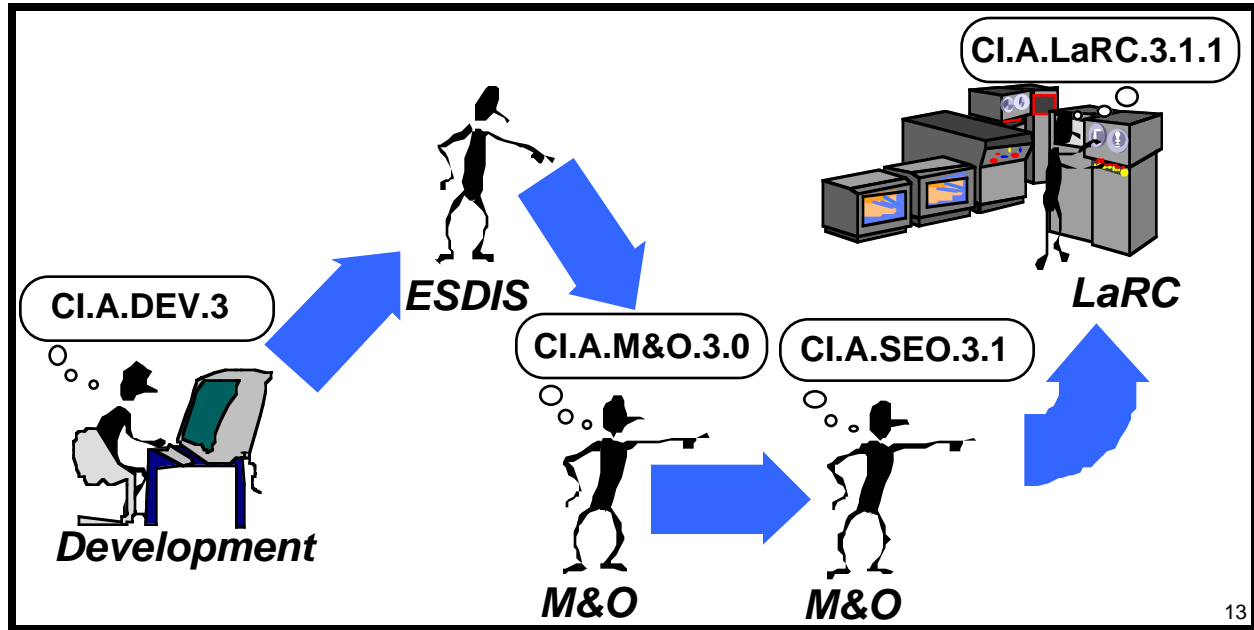
A standard format for ECS extended configuration identification is:

**Control Item.Release.Organization.#\_Dev.#\_M&O.#\_Center**

where:

- **Control Item** is the ECS Project designation for the Configuration Item at Release Readiness Review (RRR) turnover.
- **Release** is the major release (A, B, C, or D).
- **Organization** is the organization that established the configuration. Valid values are **DEV** (for development), **SEO**, or a specific center acronym (e.g., **EOC**, **EDC**, **GSFC**, **LaRC**, **NSIDC**).
- **#\_Dev** is a numeric identifier applied by the development organization to the major release and/or a minor release.
- **#\_M&O** is a numeric identifier applied by the M&O/SEO organization. This field is used by the SEO to establish the system M&O baseline.
- **#\_Center** is a numeric identifier applied by each center. This field is used by the operational centers to establish the site-specific baseline.

For example, as suggested by Figure 4, a software item at Langley Research Center (LaRC) that represents a LaRC-specific baseline for a configuration item originally delivered as CI.A.DEV.3, subsequently established by M&O as CI.A.M&O.3.0, further tailored and released to the operational centers as CI.A.SEO.3.1, might be baselined as CI.A.LaRC.3.1.1.



**Figure 4. Use of Standard Format for ECS Extended Configuration Identification**

For configuration identification, the following procedure has been developed. However, because the Testbed is not a formal release and there is no Baseline Manager software for the Testbed, you will need to simplify your approach during the Testbed life cycle period.

### Configuration Identification

- 1 Assign identifiers to configuration items (CIs) and their component parts and associated configuration documentation, including revision and version number where appropriate.
  - Assign serial and lot numbers, as necessary, to establish the CI effective status of each configuration of each item of database, documentation, hardware, and software.
  - Follow ECS developer guidelines for custom-developed items.
  - Follow vendor nomenclature for COTS items.
- 2 Apply maintenance and operations (M&O) version name extensions to ECS modified item nomenclature following the standard format for ECS extended configuration identification.
- 3 Follow author-designated version control and nomenclature for documents and follow guidelines from the ECS SEO Librarian.
- 4 Support the ECS SEO Librarian's efforts to maintain linkage of the ECS documentation to ECS CIs in the Baseline Manager tool.
  - Ensure that the marking and labeling of items and documentation with their applicable identifiers enables correlation between the item, configuration documentation, and other associated data.

- 5 Maintain a release system for configuration changes.
  - 6 Maintain views of operational baselines using the Baseline Manager tool.
  - 7 Ensure that applicable identifiers are embedded in the source and object code.
- 

For configuration control, use the following procedure.

#### **Configuration Control**

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- 1 The Change Control Boards (CCBs) chartered by the ESDIS CCB shall apply configuration control measures to all the ECS CIs and the associated documentation prior to the time they are baselined for operations.
  - 2 Provide a formal and effective means for proposing engineering changes to CIs.
  - 3 Provide a formal and effective means for requesting deviations and waivers.
  - 4 Provide formal notices of revisions.
  - 5 Provide Specification Change Notices.
  - 6 Ensure the implementation of approved changes.
- 

For configuration status accounting, use the following procedure.

#### **Configuration Status Accounting**

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- 1 Issue a Change Request Manager report on new CCRs and revisions monthly.
  - Provide an annual summary of CCRs and revisions.
- 2 Ensure CCB review of all CCRs.
  - Distribute CCR copies (and Impact Analysis forms if applicable) for review prior to the CCB meeting.
  - Print and distribute a formal agenda prior to the CCB meeting.
- 3 Status open action items regularly between CCB meetings.
- 4 Conduct CCB meetings and formally record the CCB's disposition of each CCR.
  - Record actions, assignments, and due dates.
  - Distribute minutes to the standard distribution and inform those assigned responsibility of assigned action items.

- 5 Maintain document changes through the SEO Librarian.
  - When all authorized document changes have been accomplished, prepare a Document Change Notice (DCN).
  - Post the final version on the ECS Document Data Server.
  - Distribute hard copy as required.
- 6 Monitor CCR Implementation Status.
  - After CCB disposition, regularly status open CCRs until closure.
  - Class I events include: CCR to ECS Review Board for review approval; Technical Review Board; and ESDIS Disposition.
  - For M&O implementation, further events include: Consent Obtained; Item Received; Installed; Document Completed.
  - A Class I CCR is not closed until the ESDIS contract officer's authorization is received or the reference CCR has been withdrawn.
  - Class II document change CCRs may be closed with the CM Administrator's issuance of the DCN.
  - Other non-document change CCRs may be closed when the originator verifies to the CM Administrator that all specified changes have been implemented.

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For configuration audits, use the following procedure.

### **Configuration Audits**

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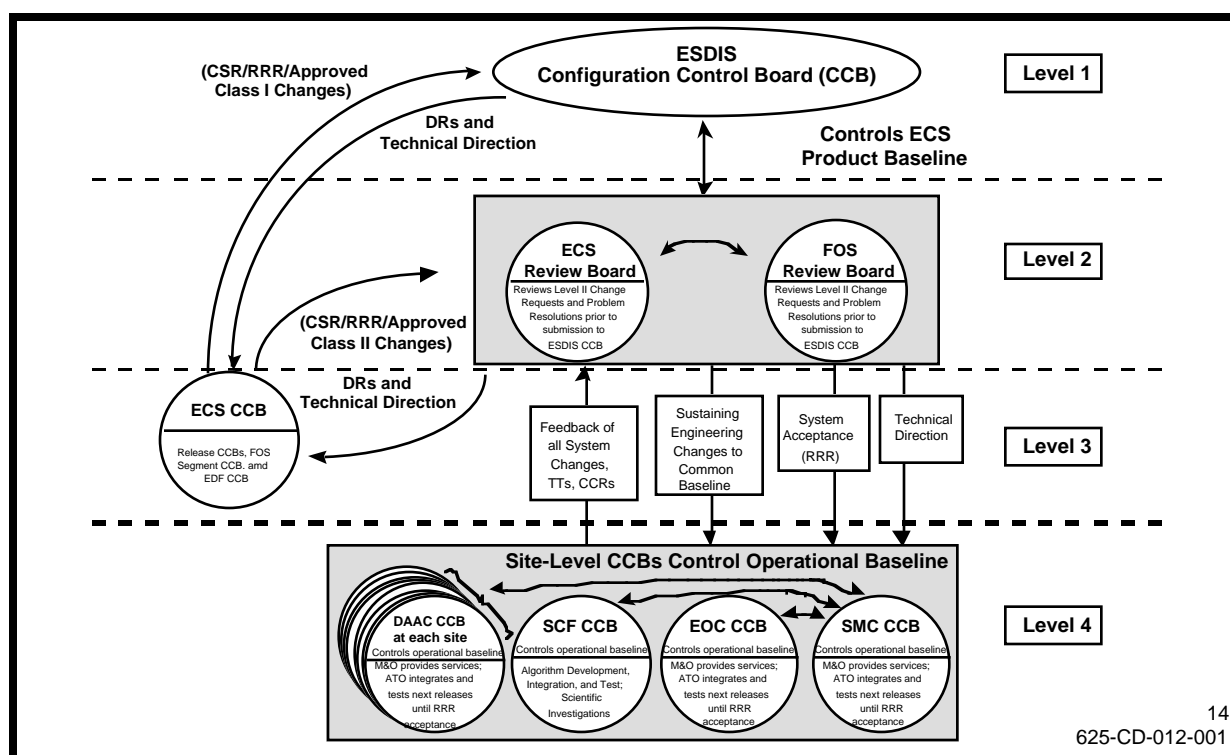
- 1 The SEO will conduct internal Functional Configuration Audits/Physical Configuration Audits (FCA/PCA) to evaluate the Project's compliance with the EOS Configuration Management Plan and the ESDIS Configuration Management Plan.
  - Verify that CM policies, procedures, and practices are being followed.
  - Verify that approved changes to documentation, and to software and hardware products are properly implemented.
  - Verify that the as-built documentation of each CI agrees with the as-deployed configuration or that adequate records of differences are available at all times.
- 2 Prepare a formal post-audit report outlining the specific items audited, audit findings, and corrective actions to be taken.

- 3 The SEO supports formal audits scheduled and conducted by ESDIS to validate that each ECS CI is in conformance with its functional and performance requirements defined in the technical documentation.
- Validate that the as-built configuration compares directly with the documented configuration identification represented by the detailed CI specifications.
  - Validate that test results verify that each ECS product meets its specified performance requirements to the extent determinable by testing.
  - Validate that the as-built configuration being shipped compares with the final tested configuration. Document any differences between the audited configuration and the final tested configuration.
  - When not verified by test, compare documentation with applicable interface specifications to establish the compatibility of ECS products with interfacing products or equipment.
  - Validate that COTS products are included in audits as integral parts of the ECS baseline.
-

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# Configuration Control Boards (CCBs)

There are multiple levels of configuration management within the ECS Project. The project Configuration Control Board (CCB) procedures exist in the context of procedures reflected in the *Mission to Planet Earth (MTPE)/Earth Observing System (EOS) Configuration Management Plan*, 420-02-02. That plan identifies the organization, authority, and responsibilities of CCBs for NASA Headquarters, the MTPE Office, Projects within the MTPE/EOS organization at GSFC, and contractors and Principal Investigators. Contractor CCB procedures, including those for ECS, are subject to the approval of their respective MTPE/EOS Project Office. For the ECS program, that office is the Earth Science Data and Information System (ESDIS). Figure 5 illustrates four levels of a CCB hierarchy for the ECS program relative to that office.



**Figure 5. Hierarchy of Configuration Control Boards**

- NASA management layers.
  - Headquarters Project Control Board (PCB): controls overall ECS mission; reviews major change requests affecting cost, schedule, and Level I performance requirements where proposed changes will alter mission objectives, cost targets, or agency schedules.

- Goddard Space Flight Center's Earth Science Data and Information System (ESDIS) (level 1): establishes ECS CM policies and, through contract, controls ECS implementation, maintenance, and operations at the various field sites. There are also four project CCBs (AM Project, PM Project, Chemistry and Special Flights Project, and Landsat 7 Project), as well as the MTPE Management Control Board (MCB), which reviews Class I project change requests prior to their submission to the NASA HQ PCB.
- ECS Review Board (level 2): This board reviews Class II change requests and problem resolutions before they are submitted to the ESDIS CCB. A Flight Operations Segment (FOS) Review Board performs the same function for Class II change requests and problem resolutions related to that segment.
- ECS Project CCB (level 3): At this level, the performing organization (ECS Development) controls ECS development activities through the RRR.
- On-site CCBs (level 4): control the operational ECS.
  - run by host organizations.
  - supported by ECS M&O.

## **Specific CM responsibilities**

Specific CM responsibilities pertain to each level: ESDIS Management -- establishes ECS CM policies.

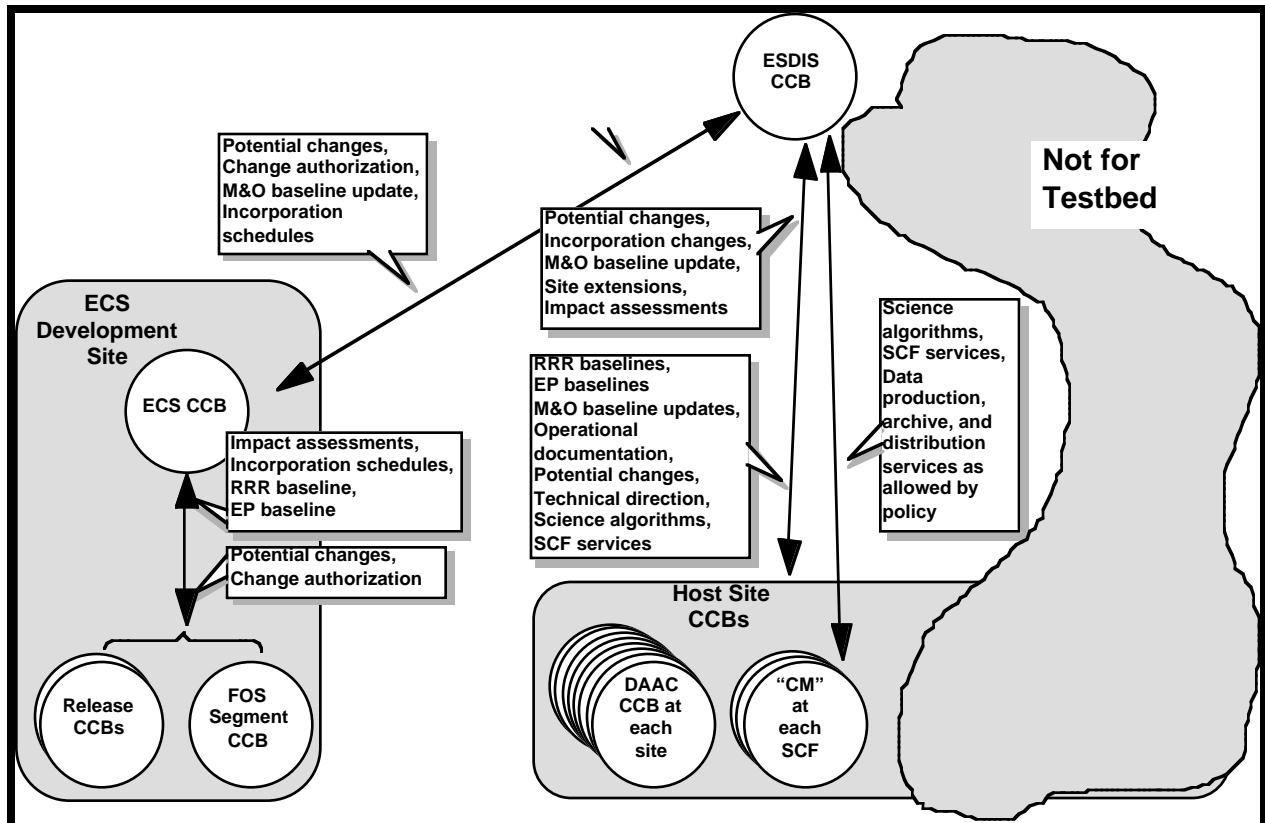
- CCBs -- classify, prioritize, evaluate, recommend, and approve (within their authority) changes to the ECS operations baselines.
- CM administrators (at SEO, EOC, DAACs, and SCFs) --
  - establish and maintain CM records, including hardware lists, drawings, and documents.
  - facilitate the configuration change request (CCR) process.
  - monitor and report status of proposed and approved CM actions.
  - support their respective CCB (as required).
- Sustaining Engineering Organization (SEO) --
  - assesses feasibility and cost, schedule and performance impacts of proposed system-wide changes.
  - implements such changes when directed by ESDIS.
- DAAC System Engineers/System Test Engineers --
  - assess DAAC impacts of system-wide proposed changes.
  - develop and maintain ESDIS-approved DAAC-specific modifications to ECS products.



- Maintenance Coordinators --
  - maintain ECS HW and report configuration changes resulting from maintenance actions.

## Relationships among CCBs

Figure 6 illustrates some of the relationships and activities in which CCBs are involved.



**Figure 6. CCB Relationship**

There are several areas of coordination and control involved in ECS configuration management:

- CCBs at operations centers and the ECS CCB interact directly with the ESDIS CCB.
- ECS sub-tier development CCBs manage installation and changes at each location prior to RRR under the governance of the ECS CCB and, as necessary, the ESDIS and host center CCBs.
- the ECS M&O organization at each center does not constitute a CCB but, rather, supports the host organization's CCB.

- the ESDIS CCB provides configuration control over all ECS developed CIs, in accordance with the ESDIS Distributed Active Archive Center (DAAC) Strategic/Management Plan.

## **Science Software and Change Control**

Each Science Computing Facility (SCF) performs its own configuration control, without an active support role by the ECS contractor. Specifically, the SCF provides two types of configuration control:

- Configuration control of software and databases that are to be executed in another site's environment.
- Configuration control of SCF resources that are made available to the EOSDIS community.

The ECS M&O CM function at each DAAC accepts science software and data items from the SCF. These items are incorporated into the DAAC's operational baseline as directed by the DAAC CCB.

The EOC controls the operational configuration of the required EOC operational baseline. The ECS M&O CM function provides services as directed.

The ECS Review Board is charged with the responsibility for centralized coordination and control of ECS CM activities to ensure:

- ECS integrity and quality of service.
- Successful coordination with both internal and external networks, systems, and on-site facilities.
- Timely ESDIS CCB visibility into and oversight of ECS operations.
- Convenient user administrative services.

# Configuration Change Requests (CCRs)

All requests for change must be documented using a Configuration Change Request (CCR) form.

- Generated against the data base, document/drawing, or hardware/software product baseline affected by the proposed change.
- Numbered items on the form correspond exactly to the data entry required to be performed by the CM Administrator using the Change Request Manager tool.
- Submitted to the appropriate CCB.
- May be used as a cover sheet for deviations and waivers.

A sample of a CCR Form appears in Figure 7.

Earth Observing System Data and Information System (EOSDIS) Core System (ECS) Configuration Change Request (CCR)					
1. Configuration Change Board (CCB) EOSDIS:____ ECS:____ SMC:____ DAAC: GSFC____, LaRC____, ASF____, EDC____, JPL____, NSIDC____, ORNL____ EOC:____				2. CCR No.	
3. Submitted Date:	4. Revision	5. Priority Emergency <input type="checkbox"/> Urgent <input type="checkbox"/> Routine <input type="checkbox"/>	6. Change Class	7. Status	
8. CCR Title:					
9. Originator:		Org:	e-mail:	phone:	
10. Approval: _____ signature		_____ date			
11. Reason for Change  (indicate attachment ____)					
12. Description of Change  (indicate attachment ____)					
13. Impact Analysis: Cost: <input type="checkbox"/> None <input type="checkbox"/> Small <input type="checkbox"/> Medium <input type="checkbox"/> Large (Not exceeding \$100,000) (\$100,000 to \$500,000) (Over \$500,000) Evaluation Engineer: _____ Org: _____ e-mail: _____ phone: _____ Impact Evaluators: EOSDIS____; ECS Dev____; SEO____; SMC____; DAACs: GSFC____, LaRC____, ASF____, EDC____, JPL____, NSIDC____, ORNL____; EOC____; Others _____ (indicate attachment ____)					
14. Comments: (Indicate Sites/ Organizations Affected)  (indicate attachment ____)					
15. Board Action: <input type="checkbox"/> Approved <input type="checkbox"/> Withdrawn <input type="checkbox"/> Disapproved <input type="checkbox"/> Deferred Until _____ date Further Action Required: <input type="checkbox"/> ECP <input type="checkbox"/> Waiver <input type="checkbox"/> Deviation <input type="checkbox"/> Tech Direction <input type="checkbox"/> Contract Mod. <input type="checkbox"/> DCN Other: _____					
16. CCB Approval Chair: _____ signature date			17. CCR Implemented CM Admin. signature: _____ date: _____		

**Figure 7. ECS CCR Form**

## Change Request Manager

Figure 8 illustrates the main screen of the Change Request Manager tool, DDTs.



**Figure 8. Change Request Manager (DDTS) Main Screen**

Suppose experience with ECS has led to discussion and consensus among operators that the label for one of the dialog boxes in one of the custom ECS applications should be changed from “File Selection” to “Production Request Selection.” As CM Administrator, you have received a paper copy or electronic mail with a CCR for the proposed change. Use the following procedure and the Change Request Manager to enter the necessary data, compose, and print the CCR.

## CCR Preparation

---

- 1 On workstation **mssx3sun**, at the UNIX prompt in a terminal window, in directory **/usr/ecs/Rel\_A/COTS/ddts/bin**, type **xddts** and then press the **Enter** key.
  - NOTE: The **x** in the workstation name will be a letter designating your site: **g** = GSFC, **l** = LaRC, **e** = EDC, and **n** = NSIDC (e.g., **mssn3sun** indicates the management services subsystem sun workstation at NSIDC). If you access the workstation through a remote login (rlogin), you must enter **xhost** + prior to the rlogin, and enter **setenv DISPLAY <local\_workstation IP address>:0.0** after the rlogin before entering the **xddts** command.
  - The **PureDDTS 3.2.1** window (top portion of the **Change Request Manager** main screen) is displayed.
  - If this is the initial execution of DDTS, a default warning dialog box is displayed indicating that you do not have any defaults established yet.
- 2 Click on the **OK** button in the warning box.
  - The warning box is dismissed.
- 3 To submit a new CCR, click on the **Submit** button.
  - The **Submit a New Defect** screen is displayed, with the **Submit to which class of projects:** field defaulted to **software**.
- 4 Type a question mark (i.e., **?**).
  - A selection box is displayed requesting the choice of **One of . . . All, Change\_Request, calls, company, hardware, issue, request, software, software.CP, and todo**.
- 5 Click on **Change\_Request** to highlight it and then click on the **OK** button.
  - The selection box disappears and your selection is entered in the **Submit to which class of projects:** field.
  - The cursor moves to the **Project name:** field.
- 6 Press the **Enter** key.
  - A selection box is displayed requesting the choice of **One of . . . Demo and ECS\_CHNG\_REQ**.

- 7 Click on your selection to highlight it, and then press the **Enter** key.
  - For preparation of a real CCR, you would select **ECS\_CHNG\_REQB**.
  - For this training exercise, or for practice, use the selection **Demo**.
  - The **Record** screen is displayed, showing a system-generated unique **CCR number** and the **Date**, with the cursor at the **Revision** field..
- 8 The **Revision** field is optional. Because this is the first submission of this CCR, press the **Tab** key to bypass this field.
  - The cursor moves to the **Priority** field.
- 9 The default priority is **routine**, which is appropriate for this CCR. Press the **Tab** or **Enter** key to select that priority.
  - For higher priority CCRs, possible entries are **urgent**, and **emergency**, which can be typed or obtained for copying from a help dialog by entering a question mark (i.e., ?).
  - The cursor moves to the **Change Class** field.
- 10 The default **Change Class** is **II**, which is appropriate for this CCR. Press the **Tab** or **Enter** key to select that class.
  - The other option is **I**, for changes handled by ESDIS because of cost, schedule, or mission impacts that may require requirements changes. To obtain that selection, press the **Backspace** key before pressing the **Tab** or **Enter** key.
  - The cursor moves to the **Title** field. (The **Status** field is system generated.)
- 11 Type up to 72 characters for a descriptive title for the CCR (e.g., in this case, **Change Dialog Name to Production Request Selection**). Then press the **Tab** or **Enter** key.
  - The cursor moves to the **Originator Name** field.
- 12 Type up to 25 characters (use the login name) to indicate the name of the person who is the author of the proposed change. Then press the **Tab** or **Enter** key.
  - The cursor moves to the first **Organization** field.
- 13 Type up to 30 characters to indicate the name of the originator's organization (e.g., **GSFC DAAC**). Then press the **Tab** or **Enter** key.
  - The cursor moves to the first **Phone Number** field.
- 14 Type the telephone number where the originator can be reached. Then press the **Tab** or **Enter** key.
  - The cursor moves to the **Organization Evaluation Engineer** field.

- 15 Type up to 25 characters (use the login name) to indicate the name of the person who initially determines whether or not the proposal has merit and should be entered into the DDTS database. Then press the **Tab** or **Enter** key.
- The cursor moves to the second **Organization** field. (The **CM Admin. Name** field is system generated.)
- 16 Type up to five characters to indicate the name of the CM Administrator's organization (NOTE: Valid values are **ASF**, **EDC**, **EOC**, **GSFC**, **JPL**, **LaRC**, **NSIDC**, **ORNL**, and **SMC**). Then press the **Tab** or **Enter** key.
- The cursor moves to the second **Phone Number** field.
- 17 Type the telephone number where the CM Administrator can be reached. Then press the **Tab** or **Enter** key.
- The **Proposed Change** enclosure screen is displayed.
- 18 The **Proposed Change** enclosure screen enables the operator to enter a free-text description of the perceived need or problem and a proposed solution. Press the down arrow key (i.e., the ↓ key) one or two times, and under the **Need or Problem** heading, type a sentence or two stating that the current title on the dialog box is causing a problem. Then use the arrow keys to move the cursor down under the **Proposed Solution** label, and type a sentence stating the proposal to change the dialog box label to "Production Request Selection."
- 19 Follow menu path **File→Save Changes and Dismiss Editor** on the **Proposed Change** enclosure screen.
- The contents of the enclosure are saved (although not yet committed to the data base!), with the entered CCR data appearing in the **Record** section.
  - The **Enclosures** window (bottom portion of the **Change Request Manager** main screen) is displayed, with a **History** icon, a **Proposed Change** icon, an **Impact Summary** icon, and a **Resolution** icon. You may double click on any of these icons. The **History** shows events (e.g., submittal of the report and addition of the **Proposed Change** enclosure). The **Proposed Change** shows the problem description and proposed solution you just entered, and permits editing of it. The **Impact Summary** and **Resolution** are forms for use later in the cycle of the CCR.
- 20 Click on the **Commit** button.
- The CCR Record is stored in the DDTS database and a message "**1 item committed to database**" appears in the status line in the top portion of the **Change Request Manager main screen**.
- 21 Click on the **Print...** button on the **Change Request Manager main screen**.
- The **Printing Options** screen is displayed. This screen provides the operator with the capability to print a highlighted CCR or all of the CCRs in the index on the main screen, either in full-page, index, one-line, or three-line format.

- 22 Ensure that the **Print Process** field contains a path and name for an appropriate print process (e.g., **/bin/lp**; if necessary see your system administrator to determine the path).
- 23 Click on the **Print...** button on the **Printing Options** screen.
- The text from the highlighted CCR is sent to the printer.
- 24 To obtain a hard copy of the CCR in the proper format, it will be necessary to use Office Automation word processing software and enter the data in an appropriate template created for the purpose. On the hard copy of the CCR, check off the designated CCB for changes processed by the ESDIS CCB and its ECS site-level chartered CCBs at the DAACs and EOC. (NOTE: This information is not entered into the Change Request Manager.)
- Select target CCB from among ESDIS, ECS, SMC, EOC, or one of the DAACs (GSFC, LaRC, ASF, EDC, JPL, NSIDC, ORNL).
-



# Impact Analysis

As an adjunct to the CCR process, support of the ESDIS CCB may require the assessment of the impact of a proposed CCR on local or system maintenance and operations. The impact assessment may be conducted by the SEO or site maintenance and operations engineers. However, assessing the impact of CCRs with significant system implications and/or potential system-wide application may require the assistance of the ECS development organization. There is a formal procedure for requesting impact analysis. It requires preparation of a form requesting CCR Impact Analysis. The form is illustrated in Figure 9.

CCR Impact Analysis	
<b>Responder Request Number:</b> _____	<b>Evaluation Engineer:</b> _____
<b>Responder:</b> _____	<b>Evaluation Engineer Point of Contact:</b> _____
Responder Point of Contract:	address: _____
address: _____	phone: _____
phone: _____	e-mail: _____
e-mail: _____	Requested Return Date: _____
CCB Schedule Date: _____	
<b>CCR Number:</b> _____	
CCR Log Date: _____	
<b>CCR Originator:</b> _____	
CCR Originator Point of Contract:	
address: _____	
phone: _____	
e-mail: _____	
<b>Rough Order of Magnitude (ROM) Impact Analysis</b>	
Basis of Estimate:	
Technical Assumptions and Comments:	
Cost Impact:	
None [ ]	
Small [ ] < \$100,000	
Medium [ ] \$100,000 < x < \$500,000	
Large [ ] > \$500,000	
Schedule Impact:	
<b>Technical Assessment:</b> ( Your impact analysis should consider the implementation approach; interfaces affected; HW or SW changes required; documentation changes required -- change from/to pages; suggested alternatives, if any; and impact to security features. If your system is not impacted, please provide that information to the CM Administrator. )	
<b>Comments:</b>	Signed: _____
	(Responder)
	Date: _____

**Figure 9. Impact Analysis Form**

The CCR Impact Analysis Form may be completed electronically using word processing software. When a CCR is distributed to the parties of record (see step 7 under “System-level Change Control” and “Site-level Change Control, pages 8 -12 of this lesson guide), an accompanying Impact Analysis form requests from each Evaluator an assessment of the projected costs and technical impacts of the proposed change. For guidance in preparing impact analysis requests, use the following procedure.

### **Impact Analysis Request Procedure**

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- 1** Determine the sites from which to request impact assessments for the CCR under consideration.
    - After the impact assessments are completed, these sites, designated impact evaluators, are entered into the Change Request Manager software (DDTS). The site(s) may be one or more of the following: **SEO, ESDIS, GSFC, LaRC, ASF, EDC, JPL, NSIDC, ORNL, SMC, EOC, EDF.**
  - 2** Enter the **Responder Request Number** on the first CCR Impact Analysis form.
    - The **Responder Request Number** can be an arbitrary sequence number from **1 - 12** which, in conjunction with the **CCR Number**, uniquely identifies the impact analysis request. The numbers **1 - 12** should be used because they correspond to numbers used to enter the impact evaluators into the Change Request Manager after the impact assessments are completed.
  - 3** Enter the **CCB Schedule Date** on the CCR Impact Analysis form.
  - 4** Enter on the CCR Impact Analysis form the **CCR Number** of the CCR to be evaluated.
  - 5** Enter on the CCR Impact Analysis form the **CCR Log Date**.
    - The **CCR Log Date** is the date the CCR was submitted.
  - 6** Enter on the CCR Impact Analysis form the data identifying the CCR Originator.
    - The data include the name of the **CCR Originator, address, phone, and e-mail**
  - 7** Enter on the CCR Impact Analysis form the data identifying the Evaluation Engineer.
    - This refers to the Organization Evaluation Engineer listed as the Evaluation Engineer on the CCR. The data to be entered include the name of the **Evaluation Engineer, address, phone, and e-mail**
  - 8** Enter the **Requested Return Date** on the CCR Impact Analysis form.
    - The **Requested Return Date** should be set for up to two weeks prior to the CCB Schedule Date, to allow preparation and entry of a summary of all Impact Assessments and to permit submission of the CCR with the CCR Impact Summary to the CCB one week prior to the schedule date for the CCB meeting.
  - 9** Repeat steps 2 - 8 for each additional Impact Evaluator identified in Step 1.
-

When the Impact Assessment requests are received at the site(s) of the Impact Evaluators, a responder is assigned to conduct the assessment and prepare the response. The responder conducts the assessment and fills in the necessary data on the Impact Analysis form:

- The Impact Evaluator returns the CCR Impact Analysis form to the requesting Evaluation Engineer. The Evaluation Engineer uses the returned Impact Analysis data to prepare a CCR Impact Summary form. The form is illustrated in Figure 10.

**Figure 10. CCR Impact Summary Form**

The Evaluation Engineer may complete the CCR Impact Summary form electronically using word processing software. The CM Administrator then uses the Change Request Manager software (DDTS) to enter the Impact Summary and attach it to the CCR. To attach a CCR Impact Summary using the Change Request Manager tool, use the following procedure.

### Preparing a CCR Impact Summary

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- 1 With the **Change Request Manager** open and its top window listing CCR records which have been committed to the data base, double click on the CCR to be modified through attachment of the Impact Summary.
  - The **Record** window (middle portion of the **Change Request Manager main screen**) shows the data for the selected CCR.
- 2 In the **Record** window, follow menu path **Change\_State→Assign-Eval**
  - The **Record** screen displays associated data fields for assigning impact assessment and the cursor at the **Evaluation Engineer:** field.
- 3 Enter the name of the **Evaluation Engineer** and then press the **Enter** key or the **Tab** key.
  - Use the login name (up to 8 characters) of the engineer responsible for analyzing the proposed system change.
  - The cursor moves to the **Organization:** field
- 4 Press the **Enter** (or **Tab**) key.
  - A selection dialog is displayed requesting the choice of **One of . . . ASF, EDC, EOS, GSFC, JPL, LaRC, NSIDC, ORNL, SEO, SMC.**
- 5 Click on your selection to highlight it and then click on the **OK** button.
  - The selection dialog disappears and your selection is displayed in the **Organization:** field.
  - The cursor moves to the **Email address:** field
- 6 Other entries on the screen are optional; as desired, enter any of the optional data: Evaluation Engineer's **Email Address, Impact Evaluators, Sites Affected, Related CCR#, CI Affected, Documents Affected, Release Affected, Baselines Affected.**
  - The **Impact Summary** enclosure screen is displayed.
- 7 Enter information as desired from the Evaluation Engineer's CCR Impact Summary.
  - The **Impact Summary** enclosure screen allows entry of free-text information under headings of **Summarize the impact statements received from the organizations requested to provide impacts, Resources Summarized, Technical Summary, ROM Summary (BOE, Cost, and Schedule), and Recommendation.**

- 8 Follow menu path **File→Save Changes & Dismiss Editor** to save the enclosure.
- The selected state, **Assigned-Eval**, is now shown as the current state (Status) of the CCR record.
  - The entered **Impact Summary** data is saved (although not yet committed to the data base!) in the **Impact Summary** enclosure.
- 9 Click on the **Commit** button.
- The CCR Record is stored in the DDTS database.
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# Software Baselines and Changes

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Software releases are deployed by the ECS CCB or SEO with approval of the ESDIS CCB:

- Version Description Document (VDD) provides summary documentation package.
- ECS Project CMO or SEO maintenance programmers assemble and package the delivery.
- delivery, with ESDIS permission, directly to the sites.

A number of situations may require a change in software baselines. For example:

- *a COTS software problem* – an operator or user reports (using a Trouble Ticket) a problem with a COTS software package, and the vendor provides a patch to resolve the problem.
- *a custom software problem* – an operator or user reports (using a Trouble Ticket) a problem with custom ECS software, and the resolution involves a software modification.
- *a science software upgrade* – the Science Computing Facility (SCF) develops and provides an upgrade to the science software and the Science Software Support Team recommends its implementation.
- *a COTS software upgrade* – one of the COTS software packages is upgraded by its commercial developer, and the upgrade is shipped by the vendor to the ECS Property Administrator, in accordance with the vendor's contract.
- *a system enhancement* – a science user or one of the DAAC operators proposes an enhancement to one of the ECS custom software configuration items, and, when approved by the ESDIS CCB, the enhancement is developed by the SEO or by the ECS development organization.

## Software Transfer and Installation

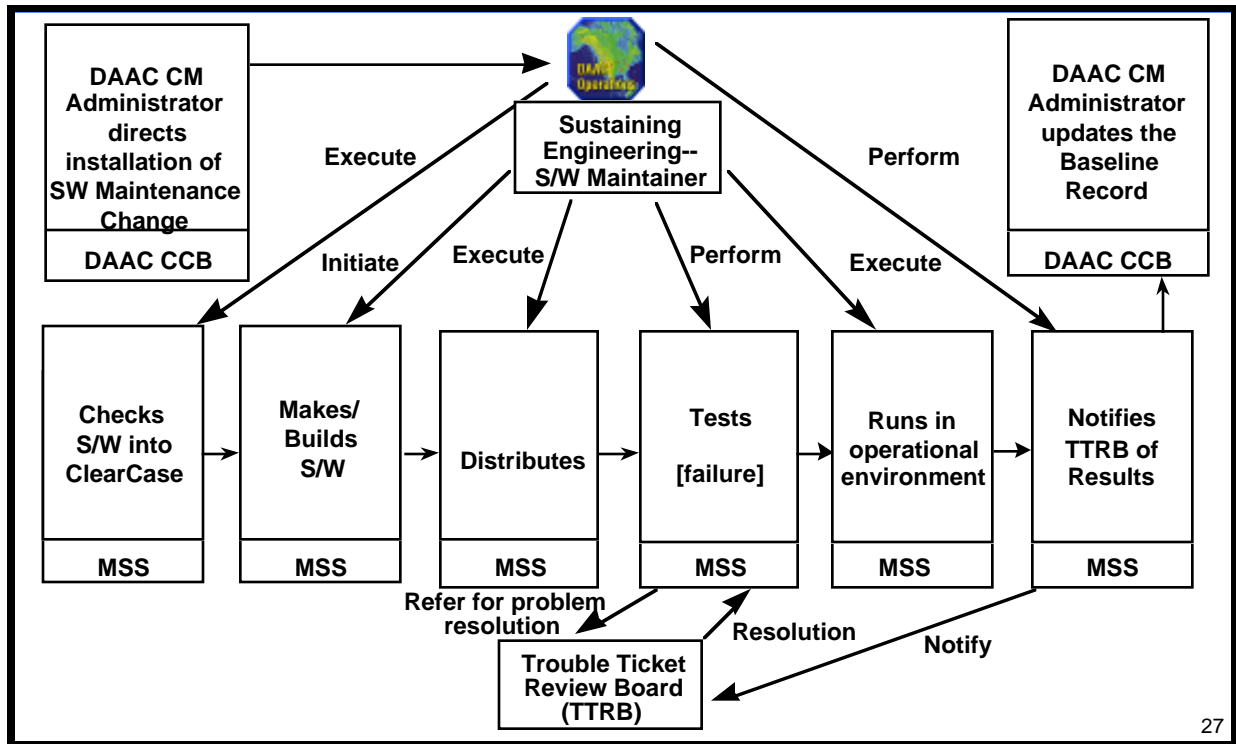
For any of the scenarios, a software maintenance package that has been prepared by the SEO is transferred to a remote site (a DAAC), and later the package is installed on a selected host computer under a CM-controlled process.

- Change originates at the SEO, beginning when the CM Administrator receives the software maintenance change.
- SEO CM Administrator provides ECS system-wide CM and exercises control and/or monitoring over the configurations.
- SEO CM Administrator directs transfer to a designated DAAC drop-off point, the SEO on-site software library.
- SEO CM Administrator ensures that changes are properly documented and coordinated, and maintains control of all configured hardware and software.

Figure 11 illustrates the functional flow for installation.

- At the DAAC, the installation actions are executed by the DAAC Software Maintenance Engineer.
- The installation is under direction from the DAAC CCB.
- The DAAC CM Administrator ensures that changes are properly documented and coordinated, maintains control of all configured hardware and software, and assists in the development and administration of the library with respect to CM procedures.
- The DAAC Software Maintenance Engineer produces, delivers, and documents corrections, modifications, and enhancements made to ECS software (including COTS products), and/or adapts or incorporates COTS software for ECS use.
- The DAAC System Test Engineer develops and executes tests of received software changes with the support of DAAC operators, and submits requests to the DAAC Resource Planner for installation scheduling.

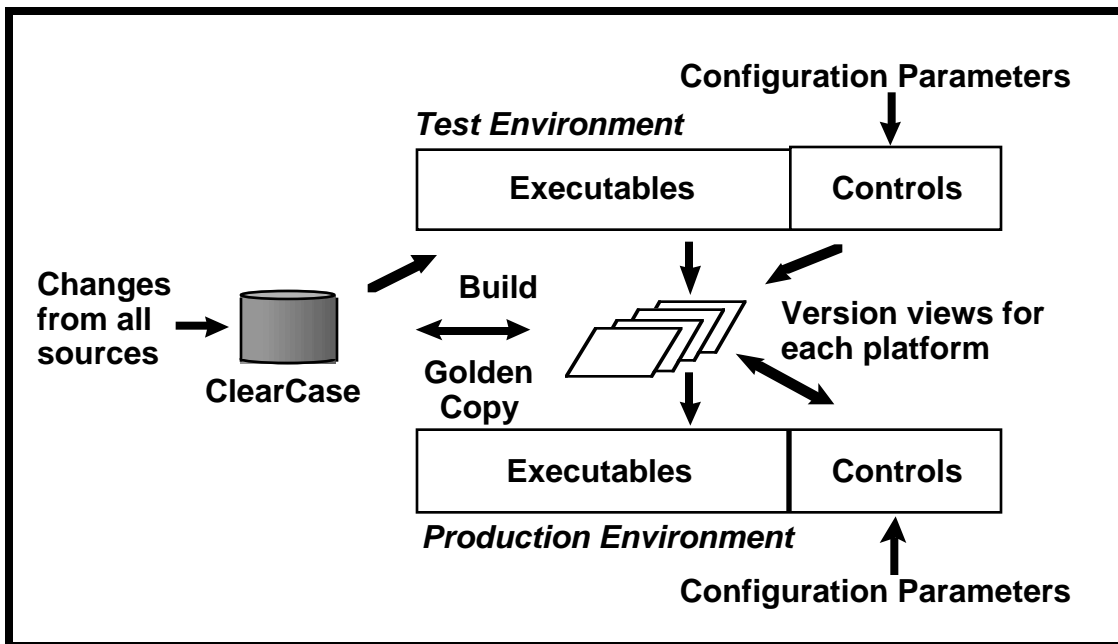




**Figure 11. Software Installation Functional Flow**

### Installation at Site using the Software Change Manager (ClearCase®)

The installation at the site is managed through the use of the ECS Software Change Manager tool, ClearCase®. Figure 12 illustrates its role in the process, ensuring that the approved baseline version of a production software is always retained separately from modified versions that may be undergoing testing.



**Figure 12. Site Software Installation Using ClearCase® Software CM Tool**

Installation is dependent on Review and approval by ESDIS, and then proceeds systematically:

- the Version Description Document (VDD) gets final updates for system and center-specific material identified by ESDIS or the operational centers, and the final VDD is published.
- the build is installed, along with operational and user documentation.
  - ClearCase®: Multiple versions of production software always retained.
  - Scripts for System Administrator to do installation.
- controlled document updates are provided to SEO Document Maintenance and entered into the CM system.
- the CM system is updated to reflect M&O and center-specific baselines.

The steps involved in software installation at the site are documented in the following procedures.

### Software Transfer and Installation

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- 1 Mount the software change package delivery medium (e.g., CD ROM).
- 2 On workstation **mssx2sun**, at the UNIX prompt in a terminal window, to put the package on the system, type **tar -xvf /<dev/cd0** and then press the **Enter** key.
  - NOTE: The **x** in the workstation name will be a letter designating your site: **g** = GSFC, **l** = LaRC, **e** = EDC, and **n** = NSIDC (e.g., **mssn2sun** indicates a management services subsystem sun workstation at NSIDC). If you access the workstation through a remote login (rlogin), you must enter **xhost +** prior to the rlogin, and enter **setenv DISPLAY <local\_workstation IP address>:0.0** after the rlogin before entering the **tar** command.
  - The software change package directory structure is copied onto the system.
- 3 To go to the parent directory of the UNIX directory structure to be brought into ClearCase® (i.e., the software change package), type **cd parentdir** (where **parentdir** is the path of the directory that contains the directory structure to be brought into ClearCase®) and then press the **Enter** key.
  - This directory must not be in the VOB.
- 4 Create a conversion script by typing **clearcvt\_unix -r dirname**, where **dirname** is the name of the directory containing the directory structure to be brought into ClearCase® (i.e., the software change package).
  - The command “clearcvt\_unix” is a custom command that creates a script to check all the files in **dirname** into the VOB.
  - The addition of “-r” to the command ensures that any subdirectories below **dirname** will be recursively included in the script created.
  - In the **parentdir** directory, a subdirectory **cvt\_dir** is created with the script and necessary files to create the required elements within ClearCase®.
- 5 At this time the DAAC CM Administrator logs out from this workstation. The DAAC System Administrator (SA) completes the procedure.
  - The remaining steps are accomplished by the DAAC SA.

- 6 Log into the vob server platform (**mssx~~n~~sun**) by typing **username** and then pressing the **Enter** key.
  - NOTE: The **x** in the platform name will be a letter designating your site: **g** = GSFC, **l** = LaRC, **e** = EDC, and **n** = NSIDC. The **n** will be a numeral indicating the MSS workstation that is the vob server (e.g., **mssn2sun** indicates a management services subsystem sun workstation at NSIDC). If you access the workstation through a remote login (rlogin), you must enter **xhost** + prior to the rlogin.
  - The cursor moves to the **Password** field (or, if you are logging in remotely from a terminal window, a **Password:** prompt appears).
- 7 Type the **password** and then press the **Enter** key.
- 8 In a terminal window, log in as the VOB administrator by typing **su - vobadm** and then pressing the **Enter** key.
  - The prompt indicates shows that you are logged in as the **vobadm**.
- 9 Type **setenv DISPLAY <local\_workstation IP address>:0.0** and then press the **Enter** key.
- 10 To change to the ClearCase® start-up directory, type **cd /usr/atria/bin** and then press the **Enter** key.
  - The prompt shows the directory as **/usr/atria/bin**.
- 11 Type **xclearcase &** and then press the **Enter** key.
  - The ClearCase® **Transcript** screen is displayed as the View Tag Browser loads.
  - The ClearCase® **View Tag Browser** screen is displayed listing available views.
- 12 Click on the desired view name to highlight (select) it and display its name in the **Select view tag** field, and then press the **Enter** key or click on the **OK** button.
  - The ClearCase® **Transcript** screen is displayed as the File Browser screen loads.
  - The ClearCase® **File Browser** screen is displayed.
- 13 To create a view for checking in the software change package, follow menu path **File→Execute→Single Command**.
  - A String Browser window is displayed containing a field labeled **Enter shell command to run:**.
- 14 Type **"mkview viewname"** and press the **Enter** key or click on the **OK** button, where **viewname** is the name of the new view (e.g., **SAName\_changepackage**).
  - A terminal window displays a message that the create view is successfully executed.

- 15 Follow menu path **View**→**Set** to return to the **View Tag Browser** to set the newly created view for the software change package.
- 16 Click on the name of the view for the software change package to highlight it, and then click on the **OK** button at the bottom of the screen..
  - The ClearCase® **File Browser** screen is displayed with the new view set.
- 17 Type into the directory input box of the **File Browser** the name of the directory in the VOB (e.g., /vobhome/SSIT/) where the software change package is to be imported and then press the **Enter** key or click on the **Confirm** button.
  - The display shows the files in the entered directory.
- 18 To create the new directory under ClearCase®, follow menu path **File**→**Execute**→**Single Command**.
  - A String Browser window is displayed containing a field labeled **Enter shell command to run:**.
- 19 Type /<parentdir>/cvt\_dir/cvt\_script and press the **Enter** key or click on the **OK** button, where **parentdir** specifies the path/location of the **cvt\_dir** created in **Step 4**.
  - A terminal display window appears and displays a message **Converting files . . .** and confirming other script actions (e.g., checkout of the directory, creation of ClearCase® elements, checkin of the directory, and setting of permissions).
- 20 On the **File Browser** screen, follow menu path **File**→**Exit**.
  - The ClearCase® Graphical User Interface session is closed.

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Subsequently, the DAAC Software Maintenance Engineer implements and tests the new software:

- Initiates software transfer to compiler hosts for make and build.
- Initiates software distribution.
- Tests individual packages (unit, subsystem, system).
- Runs the full final software in the operational environment.
- Notifies the SEO of the results.

Finally, the DAAC CM Administrator updates the site baseline record. The Testbed does not include a Baseline Manager software tool (XRP-II is to be provided as part of later releases). Nevertheless, it is recommended that you keep a written record to document the changes. As a minimum, it is desirable to record:

- DAAC CCR Number.
- Software Package Identification.
- Package Name.
- Software Upgrade Name.
- Version.
- File Structure.
- Type.
- Installation Date.

# Hardware Baselines and Changes

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The hardware baseline is established at Release Readiness Review (RRR) or, for the Testbed, system turnover to M&O. The baseline is established following formal Physical Configuration Audit (PCA).

- ESDIS approves the establishment of the operations baseline.
- The configuration baseline is recorded in the Engineering Release Record.
- M&O conducts testing of builds to ensure proper implementation of CCRs with no defects introduced.

Changes to the hardware baselines are anticipated to be infrequent, because the hardware is primarily COTS. In the event of hardware failure, if the repair can be made with a part of the same make, model, and version as the faulty one, there is no need for a CCR because the baseline remains the same. Under some circumstances, however, a CCB action may be necessary. For example:

- *a COTS hardware repair that requires a CCR* -- a COTS hardware problem that is repaired, under emergency conditions and with the approval of the site manager, with a part that does not conform to the baseline (e.g., timely repair is essential and the only spare part available is a later version) requires a CCR to document the configuration change and the authority for the change.
- *a system enhancement* – any change in hardware configuration that occurs in a new release, or as an upgrade, requires a CCR.

## Hardware Installation

Repair with part of same make, model, version may be made by the vendor's maintenance technician; the Maintenance Engineer simply records the action and enters the serial number of the new part in the property management system.

If no spare of the baseline make, model, and version is available to make a timely repair for a system that must be returned to service immediately, but a workable part is available (e.g., a later version), the site manager may authorize that part to be used for repair if tests conclude that it works properly. Nevertheless, this constitutes a change that requires the following CM actions:

- preparation of a CCR to document the change.
- review/approval by the site CCB.
- review by SEO/ESDIS to assess impacts/applicability to other sites.
- provision of controlled document updates to SEO Document Maintenance and entry into CM.

- CM system updates to reflect the change.

## **Hardware Configuration Audits**

For hardware installation, the SEO supports FCA/PCA by the Acceptance Testing Organization (ATO) at the Release Readiness Review (RRR), or, for the Testbed, system turnover to M&O. The SEO also conducts internal CM self-audits and supports audits by ESDIS and the ECS Quality Office function. Self audits evaluate compliance with the EOS Configuration Management Plan (CMP) and the ESDIS CMP. The CM self-audits verify:

- that CM policies, procedures, and practices are being followed.
- that approved changes to documentation and products are properly implemented.
- that the as-built documentation of each configuration item agrees with the as-deployed configuration or that adequate records of differences are available at all times.

The SEO prepares a post-audit report outlining the specific items audited, audit findings, and corrective actions to be taken. All action items are tracked to closure.

In support of formal audits scheduled and conducted by ESDIS, the SEO assists in validating that each ECS configuration item is in conformance with its functional and performance requirements defined in the technical documentation. These audits validate that:

- the as-built configuration compares directly with the documented configuration identification represented by the detailed configuration item specifications.
- test results verify that each ECS product meets its specified performance requirements to the extent determinable by testing.
- the as-built configuration being shipped reflects the final tested configuration. Any differences between the audited configuration and the final tested configuration are documented.
- when not verified by test, the compatibility of ECS products with interfacing products or equipment is established by comparison of documentation with the interface specifications which apply.
- COTS products are included in audits as integral parts of the ECS baseline.



# Changes to the Baseline

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Among the ECS CM tools, for the Testbed, one is involved in every change to a configuration item:

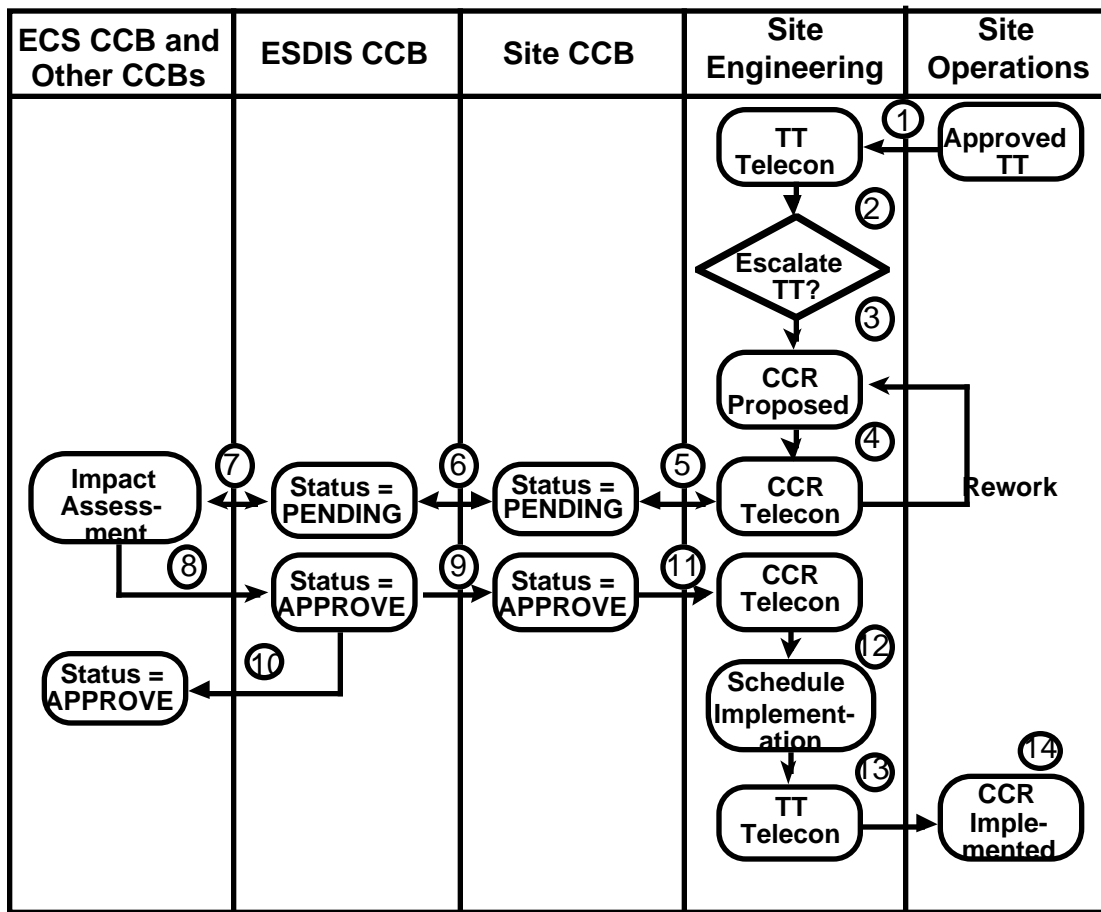
- the Change Request Manager – Distributed Defect Tracking System (DDTS).

You will no doubt remember, however, that the impetus for a change may often be a system event that results in a Trouble Ticket.

## Management Subfunction and Trouble Ticket System

Many changes involve the management subfunction software. Specifically, the management software includes the Trouble Ticket System (TTS), which is a tool used at the DAACs, SMC, and EOC to record and report problems with ECS. Most of the problems encountered are fixed locally, but some problems involve system-level issues. For those, the SEO may use a TT Telecon to discuss the issues. Problems that may have such system-level implications are those that may be related to groups of trouble tickets (TTs), that may affect more than a single site, that must be referred to the ESDIS Project Office and the ECS development organization, or that require coordination for multi-site change implementation.

Figure 13 shows the flow of a TT and related CCR through the various CCBs and the TT Telecon. Circled numbers on the figure indicate key elements in the flow:



**Figure 13. CCR Approval Flow**

1. An approved TT is discussed at a TT Telecon.
2. At the Telecon, a decision is made whether to escalate the resolution of the TT.
3. If the decision is to escalate, rather than resolve the issue with a local solution, a CCR is proposed.
4. A CCR Telecon and related deliberations may result in iterations of rework, entailing related CCRs, responsibility for the affected configuration items, impact analysis, and other activities to optimize the resolution.
5. The site CCB deliberates on the CCR.
6. The site CCB forwards the CCR with recommendations to the ESDIS CCB.
7. As necessary, the ESDIS CCB forwards the CCR to the ECS CCB and other CCBs for impact assessment.

8. If appropriate, elements 5, 6, and 7 may be iterated in rework with additional deliberations and feedback, with possible disapproval. Otherwise, the CCR is approved for further action by the ESDIS CCB.
9. If the ESDIS CCB approves the CCR, it may issue CCR Implementation Instructions to the site CCB.
10. If the CCR entails additional development affecting ECS, the ESDIS CCB may issue CCR Implementation Instructions to the ECS CCB and/or other CCBs.
11. The site CCB issues CCR implementation directives, and their status is monitored and coordinated with the SEO through a CCR Telecon.
12. The CCR Telecon also coordinates the schedule for implementation of changes that is reported back to the TT Telecon.
13. The TT Telecon monitors the scheduled implementation.
14. At the conclusion of the scheduled implementation, the CCR is verified.

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# Practical Exercise

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## Introduction

This exercise is designed to practice key elements of the Configuration Management procedures. Perform the tasks identified in the exercise.

## Equipment and Materials

One ECS workstation.

## Custom Software Problem

This exercise involves a problem with custom software developed for ECS and maintained by the SEO.

A member of a instrument team trying to apply one of the ECS Science Data Processing toolkits experiences an inability to get the desired results when using the toolkit during a Science Software Installation and Test (SSI&T). The instrument team member reports the problem to the site's Maintenance Coordinator. The Maintenance Coordinator records the information and opens a Trouble Ticket (TT). The TT is routed to the site Sustaining Engineer(s) for diagnosis. The Sustaining Engineer verifies that the toolkit's interface to the science software application does not provide the desired results and identifies that there are source statements in the software that are in error. The engineer estimates that it will take one person-month to correct and test the toolkit application.

1. Generate a CCR for the software change.
2. Prepare distribution lists for review of the proposed changes.
3. Use ClearCase® to process the transfer and installation of the software patch.
4. Perform the required Change Control Accounting for the software and hardware changes.

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# Slide Presentation

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## Slide Presentation Description

The following slide presentation represents the slides used by the instructor during the conduct of this lesson.

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